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ON THE MEAN AGE AT DEATH OF CENTENARIANS*

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Some years ago I investigated the mean age at death of infants dying at very early ages.¹ The purpose of that study was to determine with accuracy where the deaths under one year should be centered in statistical computations involving the computation of moments, where one had to know the center

TABLE 1
AGE DISTRIBUTION OF CENTENARIAN DEATHS IN THE REGISTRATION AREA, 1916

AGE. <i>years</i>	MALES		FEMALES	
	White	Colored	White	Colored
100	48	42	72	85
101	15	4	30	8
102	14	10	25	19
103	12	11	15	14
104	17	5	9	14
105	14	8	18	27
106	2	7	5	8
107	5	1	1	2
108	2	6	1	5
109	1	1	0	2
110	4	7	2	15
111	1	4	0	3
112	0	1	0	3
113	0	2	0	0
114	2	0	1	1
115	0	2	1	4
116	0	1	0	3
118	0	2	0	0
120	0	2	0	2
134	0	0	0	1
Totals.....	137	116	180	216

of gravity of each frequency area over given base units. In an investigation which I am now undertaking I have been confronted with the same problem at the other end of the life span. In the "Mortality Statistics" published by the Bureau of the Census, the deaths occurring at ages of 100 and over are lumped in a single class. In calculating the frequency constants of mor-

* Papers from the Department of Biometry and Vital Statistics, School of Hygiene and Public Health, Johns Hopkins University, No. 3.

tality curves, it is obvious that these centenarian deaths must be centered at some point. The finding of as close an approximation as possible to the correct centering point has been attacked along two lines, with the results set forth in this paper.

In the first place, actual deaths occurring in the year 1916 in the Registration Area of individuals reported to the Census Bureau as having died at age 100 or more were studied. Detailed statistics giving the distribution of these deaths by years was very kindly furnished me by Dr. William H. Davis, Chief Statistician of the Vital Statistics Division, Bureau of the Census. I wish to record here my obligation to Doctor Davis for furnishing me with this tabulation.

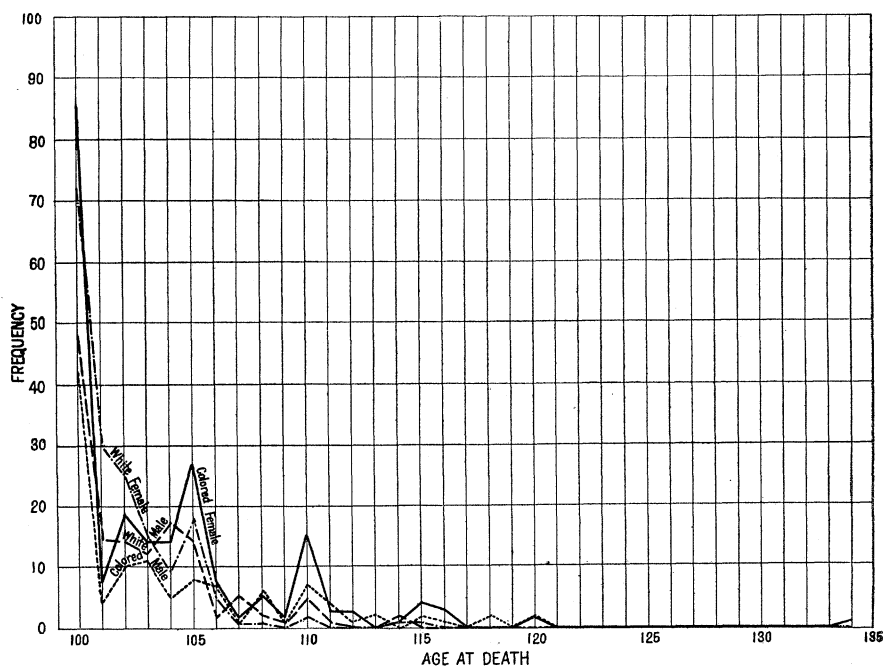


FIG. 1. DISTRIBUTION OF THE DEPTHS IN THE REGISTRATION AREA IN 1916, AT AGE 100 OR MORE

These figures are set forth in table 1, and graphically in figure 1.

It is apparent at once from the table and diagram that there are gross errors in the records of ages in these centenarian deaths. Unquestionably, some people do live to very advanced ages² but it is equally clear that they do not occur in such numbers, nor at such advanced ages as would be indicated by these figures, taken at their face values.

Particularly are the figures for the colored population obviously incorrect. One notes the outstanding humps in the colored female line at the quinquennial years, 100, 105, 110, etc. These, of course, have no foundation in fact. In

the case of the whites, the statistics are undoubtedly more accurate, and one would certainly not be justified in going so far as does Clark³ in denying the existence of centenarians except in the very rarest cases.

From the unmodified data in table 1, the constants shown in table 2 have been deduced.

Before commenting on the data of table 2, it is desirable to present the results of another method of approach to the matter. That method is to take the number of deaths for each year over 100 from the d_x column of a properly graduated mortality table, and calculate from such figures the means and standard deviations. The mortality tables which have been used for this

TABLE 2

CONSTANTS FOR DEATHS OF CENTENARIANS IN THE REGISTRATION AREA IN 1916

GROUP	MEAN	STANDARD DEVIATION
	<i>years</i>	<i>years</i>
White males.....	103.19 \pm 0.17	3.02 \pm 0.12
White females.....	102.42 \pm 0.12	2.49 \pm 0.09
White, both sexes together.....	102.75 \pm 0.10	2.76 \pm 0.07
Colored, both sexes together.....	104.45 \pm 0.18	4.89 \pm 0.13

TABLE 3

DEATHS OF CENTENARIANS FROM UNITED STATES LIFE TABLES

x TO $x + 1$	d_x OF 100,000 BORN ALIVE			
	White males	White females	Negro males	Negro females
100-101	13	19	13	34
101-102	8	11	10	26
102-103	5	6	7	18
103-104	3	4	4	13
104-105	1	2	3	9
105-106	1	1	1	5
106-107	0	1	1	3
107-108	0	0	1	2
108-109	0	0	0	1
109-110	0	0	0	1

purpose are Glover's⁴ 1910 American mortality tables. The distributions of death which these tables give for white and colored are exhibited in table 3.

As would be expected the distributions in table 3 are much smoother than those of table 1. Furthermore, their range is less extended at the upper end. The constants for the distributions in table 3 are exhibited in table 4.

From these tables the following points are to be noted:

1. As was to be expected the mean ages at death are sensibly lower, and the standard deviations smaller, when the graduated data of the life tables are used instead of the raw statistics.

2. Inasmuch as the life table values given in table 4 are certainly nearer the true values than those of table 2, they may well be adopted as the basis of centering deaths over 100 in biostatistical computations.

3. Accordingly in this laboratory the deaths of whites, both male and female, occurring at 100 years and over will be assumed to center at 101.7

TABLE 4
MEAN AGE AT DEATH AND STANDARD DEVIATION IN AGE AT DEATH OF CENTENARIANS,
FROM UNITED STATES LIFE TABLE FIGURES

GROUP	MEAN	STANDARD DEVIATION
White males.....	101.66	1.32
White females.....	101.73	1.49
Whites, both sexes.....	101.70	1.42
Negroes, both sexes.....	102.32	1.92

years, and those of negroes at 102.0. The latter value is probably still too high, but unless one repudiates the statistical data entirely, which would amount to throwing away the child with the bath, there is no warrant for arbitrarily taking a lower value.

¹ Pearl, R., *Biometrika*, 4, 1906, (510-516).

² Cf. the authentic case reported by Rodriguez (in *Siglo med.*, Madrid, 53, 1906, (341-343) > of death at 124 years of age.

³ Clark, F. C., *Providence, Med. J.*, 10, 1909, (143-158).

⁴ Glover, J. W., United States Life Tables, 1910. Bureau of the Census 1916.